stream/down-stream return path packets back into a network (wavelength) compatible packet stream. There will be a wavelength packet multiplexer for each primary transmission wavelength for down-stream and up-stream wavelength (channel) directivity within the aggregation node. The plurality of wavelength packet multiplexers 225 will accept packet traffic that is loaded on a specific wavelength channel, but is not designated for local distribution or cross-connecting. The plurality of wavelength packet multiplexers 225 multiplexes the wavelength packets and inserts the wavelength packets into a suitable out-going up-stream/down-stream direction specific wavelength channel for transmission to another node designated by their header information.

[46] At the cross-connect layer, specific wavelength packets may come from a local customer 1 and are electrically detected, wavelength assigned and directed to the node's wavelength packet cross-connect 265 and on to customer 2's premises 270. The optical packets transmitted from customer 1 are optically-to-electrically detected at the bi-directional Lambda 1 to Lambda "n" converter 250, the header information is electrically read and the electrical packet is directed to a electrical-to-optical converter 255 for conversion to a wavelength suitable for transfer through the wavelength packet cross-connect 265, either to the up-stream or down-stream wavelength packet multiplexer or onto the wavelength packet cross-connect 265. Wavelengths are selected (via the local radio communications inter-node layer) so as to not "crash" with non-available wavelengths on the other side of the wavelength packet cross-connect 265 or wavelength packet multiplexer 225. Therefore, wavelength "packets" are able to travel from one distribution node to another distribution node via the cross-connects. Similarly optical packets coming from customer 2 are first wavelength configured (if needed), via the bi-directional Lambda 1 to Lambda "n" converter located on customer 2's side 270 of the wavelength packet cross-connect 265 and then directed to the customer 1's bi-directional Lambda 1 to Lambda n converter 250 where they are electrically detected (if needed), and assigned a wavelength and switch (port) within the local distribution routing layer for transport on to customer 1's premises 260. Note these arrangements allow customer 1 to customer 2 connectivity without having

to go through the entire mesh network. Alternate means besides optical-to-electrical and electrical-to-optical wavelength selection exist and may be applicable. The current embodiment utilizes optical-to-electrical and electrical-to-optical (O-E-O) wavelength selection due to the local individual customers typically having lower bandwidth utilization/requirements and the lower costs associated that the greater access mesh architecture. As customers migrate to higher bandwidth utilization, O-E-O techniques may no longer be suitable for individual customer wavelength assignment so other wavelength conversion techniques may be engaged. The bi-directional Lambda 1 to Lambda "n" converter and packet generator 250 allows non-crashing wavelength assignment and cross-switching of packets between node/mesh directions.

[47] The wavelength packets, to be locally deployed to a specific local customer, must be first extracted from the wavelength channel and redirected individually to the customer port for further transmission to the customer 1's premises 260 via fiber, FSOC or RF means. Fig. 3 illustrates a serial array of high-speed optical switches or a matrix of electro-holographic switches, controlled via the local node look-up tables 210 and switch controller circuit 245, intercepting and switching individual packets out of the wavelength packet stream and directing the packets to the dedicated customer port. The customer port would connect to a distribution transport medium i.e., FSOC or radio and then be directed to a customer 1''s premises 260. The optical switching sequence of the layered optical switches, to provide connectivity from the node to node or to the customer specific port, could effectively be ganged together, in parallel, via commands generated from the wavelength packet header reader 205 in response to the packet "header" address information, thereby minimizing switch set-up time and eliminating packet storage as the correct switch sequence is being configured.

[48] Referring again to Fig. 2, in some node routing scenarios, wavelength packets may need a new wavelength channel assignment for reinsertion into the down-stream or up-stream channels. The node packet cross-switch may also require a specific wavelength channel other than the one on which the specific packet is

propagated. It is, therefore, necessary that wavelength conversions be possible within the node to meet the traffic network routing demands. The practice of wavelength conversion is available in "all optical" as well as optical-to-electrical-to-optical (O-E-O) methods. The successful wavelength/channel assignment between nodes can be negotiated through a control layer inter-node communications scheme.

[49] Now considering the upstream path, in the exemplary embodiment depicted in Fig. 2, wavelength packets can travel from one distribution/aggregation node to another distribution/aggregation node via the wavelength packet cross-connect 265. Essentially, in terms of the architecture depicted in Fig. 2, this amounts to a right angle turn for a packet at the cross-connect layer further illustrated in Fig. 4 and described hereinafter. Packets in this situation will now begin their up-stream/down-stream migration in a different direction.

[50] Customer 1's data returning to the distribution/aggregation node may not be packetized, but may be locally wavelength modulated or use other such dedicated optical modulation methods. More critically, the returning wavelengths may be provided by LEDs or lasers at different non-ITU compliant wavelengths. As such, the customer return path receiver should include, in principal, an optical-to-electrical (O-E) converter 255, preferably a photodetector of suitable speed and sensitivity and broad wavelength sensitivity. Due to the customers relatively slow data speed (compared to the network), the resulting electrical modulation signal can then be packetized and converted to a suitable wavelength compatible with down-stream, up-stream or cross-connect wavelengths assigned direction. These newly generated wavelength packets can now be directed to the wavelength packet multiplexer 225 where the newly generated wavelength packets can be multiplexed with other locally generated customer packets and inserted into the suitable outgoing multi-customer packet stream wavelength channel. Note although not shown for reasons of complexity in Fig. 2, the up-stream aggregation node also contains a wavelength packet multiplexer to insert the customer 1 packets. Suitable wavelength selected from customer 1's bi-directional Lambda 1